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Predicting significant factors of Selective Marine Corps Reserve Marines career decisions in response to the Force Structure Review review

Capdepon, Ryan F.

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NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

THESIS

PREDICTING SIGNIFICANT FACTORS OF SELECTIVE MARINE CORPS RESERVE MARINES' CAREER DECISIONS IN RESPONSE TO THE FORCE STRUCTURE REVIEW

by

Ryan F. Capdepon

March 2014

Thesis Co- Advisor:	Bill Hatch
Thesis Co-Advisor:	Chad W. Seagren
Thesis Second Reader	Kathryn Aten

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PREDICTING SIGNIFICANT FACTORS OF SELECTIVE MARINE CORPS RESERVE MARINES' CAREER DECISIONS IN RESPONSE TO THE FORCE STRUCTURE REVIEW

Ryan F. Capdepon
Captain, United States Marine Corps
B.S., Mount Olive College, 2007

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requirements for the degree of

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March 2014

Author: Ryan F. Capdepon

Approved by: Bill Hatch
Co-Advisor

Chad W. Seagren
Co-Advisor

Kathryn Aten
Second Reader

Dr. William Gates
Dean, Graduate School of Business and Public Policy

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LIST OF ACRONYMS AND ABBREVIATIONS

AD	active duty
ADOS	active duty for operational support
ADT	active duty training
AR	Active Reserve
ASVAB	Armed Services Vocational Aptitude Battery
AT	annual training
BIC	Billet Identification Code
CFT	combat fitness test
CLB	Combat Logistic Battalions
CMC	Commandant of the Marine Corps
CSS	combat service support
EAD	extended active duty
FSR	Force Structure Review
FSRG	Force Structure Review Group
FTS	full-time support
GCT	General Classification Test
GS	general schedule
HOR	home of record
IDT	inactive duty training
IMA	Individual Mobilization Augmentee
IRR	Individual Ready Reserve
IST	interservice transfer
IUT	interunit transfer
MARADMIN	Marine Administrative Message
MARFORRES	Marine Forces Reserve
MCO	Marine Corps Order
MCR	Marine Corps Reserve
MCRAMM	Marine Corps Reserve administrative management manual
MDPSD	mandatory drill participation stop date
MEU	Marine Expeditionary Units

MFR	Marine Forces Reserve
MLG	Marine Logistic Groups
MOS	military occupational specialty
MOS Manual	Marine Corps occupational specialties manual
MSO	military service obligation
NPS	non-prior service
NCO	noncommissioned officer
PFT	physical fitness test
PS	prior service
PTT	Personnel Transition Team
RCP	retirement credit points
ROC	Receiver Operating Characteristics
RR	Ready Reserve
SAS	Statistical Analysis System
SecDef	Secretary of Defense
SelRes	Selected Reserve
SMCR	Selective Marine Corps Reserve
SNCO	staff noncommissioned officer
T/O	Table of Organization

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I. INTRODUCTION

A. PURPOSE

The primary purpose of this thesis is to identify significant variables that contributed to a Selective Marine Corps Reserve (SMCR) Marine's career decision when faced with changes initiated by the Force Structure Review Group (FSRG). The models provide Marine Forces Reserves (MFR) with important information regarding which factors contribute to an SMCR Marine's career decision. The findings conclude that MOS, location, performance, rank, age, deployments, and race all significantly affect a Marine's decision in at least one of the nine models.

The secondary purpose of this thesis is to provide the Marine Corps with a reference to the Personnel Transition Team (PTT) concept developed by MFR. A review of the development of the PTTs, their processes, and their actions during the Marine Corps Reserve (MCR) forces restructure is provided.

The tertiary purpose of this thesis is to develop a decision probability model. This model provides a tool to help estimate the decisions Marines may make when faced with changes similar to those initiated by the FSRG.

B. BACKGROUND

In August 2010, then Secretary of Defense (SecDef) Robert Gates directed the Marine Corps to conduct a Force Structure Review (FSR). Secretary Gates identified the purpose for the review as "to find the right balance between preserving what is unique and valuable in their traditions, while at the same time making the changes necessary to win the wars we are in and prepare for the likely future threats in the years and decades to come" (Garamone, 2010).

Since the start of Operation Enduing Freedom and Operation Iraqi Freedom, the Marine Corps has become heavily involved in fighting both wars. Fighting simultaneous wars in different countries required the Marine Corps to become a more land-based force. The SecDef, in his 2010 speech at the Marine Memorial Association in San Francisco,

mentioned that the United States does not need another land army, but an expeditionary force that can deploy quickly (Garamone, 2010). In order to meet these requirements, the Marine Corps responded with an internal review of its current force structure, manpower requirements, and focus for the future.

The Marine Corps created the FSRG to meet the requirements of the SecDef's directive. Marine Administrative Message (MARADMIN) 414/10 states that the purpose of the FSRG was "to conduct a capabilities based assessment to review the active, reserve and civilian manpower requirements of the Marine Corps" (Commandant of the Marine Corps [CMC], 2010). The MARADMIN tasked units across the Marine Corps to provide the rank of colonel or general schedule (GS) employee 15 as members of the FSRG. The goal of assembling a group of diverse and experienced members was to "evaluate and refine the organization, posture, and capabilities required of America's Expeditionary Force in Readiness in a post OEF [Operation Enduring Freedom] security environment" (Amos, 2011). The results of the FSRG had substantial effects on the Marine Corps, its organizational structure, and its personnel.

Reshaping America's Expeditionary Force in Readiness is the executive summary of the FSRG. The report highlights recommended changes to the Marine Corps active, reserve, and civilian components. The results of the FSRG identified the need for a substantial decrease in the active component manpower end strength, from 202,000 to approximately 186,800 (Amos, 2011). Other recommended changes were the restructuring of organizations and capabilities, the optimization of a forward presence, and the creation of a reserve component that would mirror the active component.

This thesis focuses on the effects the FSR had on the MCR component. *Reshaping America's Expeditionary Force in Readiness* recommended the following changes to the reserve component:

- Create an operationalized reserve component with no reductions in manpower.
- Reorganize Marine Logistic Groups (MLG) to establish Combat Logistic Battalions (CLB) aligned to specific Marine Expeditionary Units (MEU) and infantry regiments.

- Place the reserve division, wing, and logistic group headquarters in a cadre status and eliminate the Mobilization Command headquarters by assimilating associated functions into MFR headquarters.
- Increase civil affairs groups (three to five).
- Double counterintelligence/human intelligence.
- Increase air and naval gunfire liaison companies (two to three).

The changes to MCR forces presented difficulties that not only affected reserve units, but also the personnel in the units. The effects on units varied from a complete divestiture to a partial divestiture to a unit mission change to a name or flag change. The MFR was the lead element responsible for developing and executing a course of action to implement the changes to the reserve forces that would affect an estimated 147 of 181 total reserve units (Marine Corps Forces Reserve [MFR], 2013a, p. 25). The MFR plan to implement the changes was innovative and designed to keep faith with the Marines affected by the changes. MFR developed the PTT concept to assist the restructuring of the reserve forces, and to help the Marines affected during their transition.

PTT is a concept aimed at easing the transition for Marines affected by the FSR. The *2013 Almanac Special Issue* of *Continental Marines* magazine defined the PTT mission.

> The Personnel Transition Team aims to smooth over transitions for Marines affected by the Force Structure Review, a restructuring and modernization effort which impacts 147 of 181 Marine Forces Reserve sites. The team consists of a cadre of manpower experts who travel to affected sites with the goal of keeping faith with Marines and maintaining personnel requirements. (Marine Corps Forces Reserve [MFR], 2013a, p. 25)

The PTT task was difficult and time consuming. The teams visited reserve sites across the United States to personally meet with Marines. PTTs counseled individual Marines on available options, answered questions, and expedited processes to facilitate Marines' transitions.

C. MARINE CORPS RESERVE STRUCTURE

This thesis focuses on the Marine Corps Reserves, specifically the Ready Reserve (RR). This section provides an explanation of the RR and the elements that fall under it. For a detailed explanation of the entire MCR structure, refer to the Marine Corps Reserve Administrative Management Manual (MCRAMM), also referred to as Marine Corps Order (MCO) 1001R.1K (Commandant of the Marine Corps [CMC], 2009).

The purpose of the MCRAMM is to "establish the policies and responsibilities for the administration and personnel management of the Marine Corps Reserves" (CMC, 2009). The MCRAMM presents an organizational chart of the MCR command structure, presented in Figure 1. The elements under the RR are discussed in more detail to help develop a better understanding of the MCR.

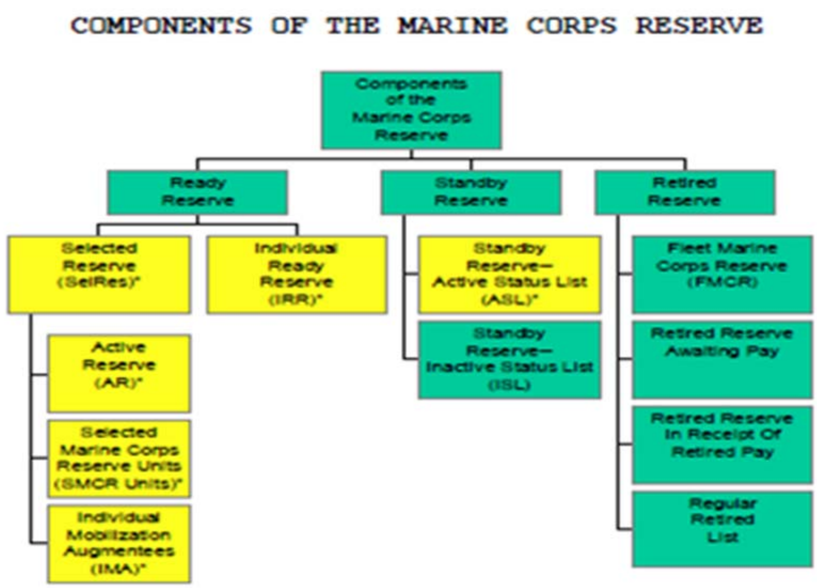

Figure 1. Components of the MCR (after CMC, 2009)

1. Ready Reserve

The purpose of the RR is to maintain readiness and provide training to prepare for immediate active duty (AD) in case of war or national emergency. The components that make up the RR consist of units and individual members that are expected to be prepared

for AD when necessary (CMC, 2009). The Selected Reserve (SelRes) and the Individual Ready Reserve (IRR) are the two main components of the RR.

a. *Selected Reserve*

The SelRes is composed of three separate elements: Selected Marine Corps Reserve (SMCR) units, Individual Mobilization Augmentees (IMAs), and the Active Reserve (AR).

(1) The SMCR consists of the 4th Marine Division, 4th Marine Logistics Group, 4th Marine Aircraft Wing, and force level units of the MFR (CMC, 2009). Reserve units affected by the FSR are all units under the SMCR.

(2) IMAs are individual reservists. They receive training and are assigned directly to an active component billet that must be filled to meet specific requirements.

(3) ARs serve in full-time AD billets. The billets filled vary depending on requirements and military occupational specialty (MOS), but mostly support the organization, administration, recruiting, retention, instruction, and training of the MCRs (CMC, 2009).

b. *Individual Ready Reserve*

The IRR is a pool of individual reservists available for mobilization when necessary. The majority of Marines in the IRR have served on active duty or in the SelRes. Marines in the IRR have been trained and can be mobilized for duty, but they do not actively train with an SMCR unit. The MCRAMM identifies IRR Marines as being in one of the following categories:

- They have not completed their military service obligation (MSO);
- They have completed their MSO and are in the Ready Reserve by voluntary agreement; or
- They have not completed their MSO and are mandatory participants, but are authorized to transfer to the IRR.

D. RESEARCH QUESTIONS

1. Primary Research Question

What variables significantly contributed to an SMCR Marine's decision when faced with unit changes from the FSR?

2. Secondary Research Question

What is the estimated probability that Marines will choose to stay, IUT, or transfer in future FSRs or similar events?

E. SCOPE AND LIMITATIONS

This thesis focuses on SMCR Marines that were affected by the changes outlined in the Marine Corps FSRG. An explanation of the PTT concept and its role in the process are included in this thesis. Multiple logistic regression models are built utilizing the data from MFR in order to determine which variables significantly impacted a Marine's decision during the FSR changes.

The immaturity of the FSR and the PTT concept along with limited history on the topics caused some limitations for this thesis. With time and the collection of data, a more in-depth analysis will provide a better understanding of the topic.

F. ORGANIZATION OF THE STUDY

This thesis is divided into six chapters. Chapter II provides a background of the PTT concept and its role during the MFR restructure. Chapter III reviews past Naval Postgraduate School theses that focus on the SMCR. The theses use logistic regression models to determine which variables significantly affect Marines' decisions to retain in the SMCR or not. Chapter IV explains the data used for this thesis, the separation of data into three models, the consolidation of dependent variables, and gives a description of independent variables. Chapter V presents the methodology, the models, the results, and the decision probability model. Chapter VI summarizes the thesis and provides a conclusion and recommendations based on the research questions and future research themes.

II. BACKGROUND OF THE PERSONNEL TRANSITION TEAMS

A. PERSONNEL TRANSITION TEAMS

This chapter provides an overview of the PTTs, their approach to the task outlined in the FSRG, and the process followed for the execution of visits. A systems model is used to examine the purpose, development, execution, and results of the PTT efforts.

The systems model in Figure 2 illustrates the development of the PTT concept. A sequential process that identifies the "input" that drove the need to develop the teams is provided. The "throughput" consists of many factors that contributed to identifying the task, the appropriate people to use, the systems necessary, and the method of building the teams to execute the task. The "results" consist of the "outputs," which provide measureable results from the PTT's execution of the task, and the "outcomes," which provide the overall result the PTT accomplished.

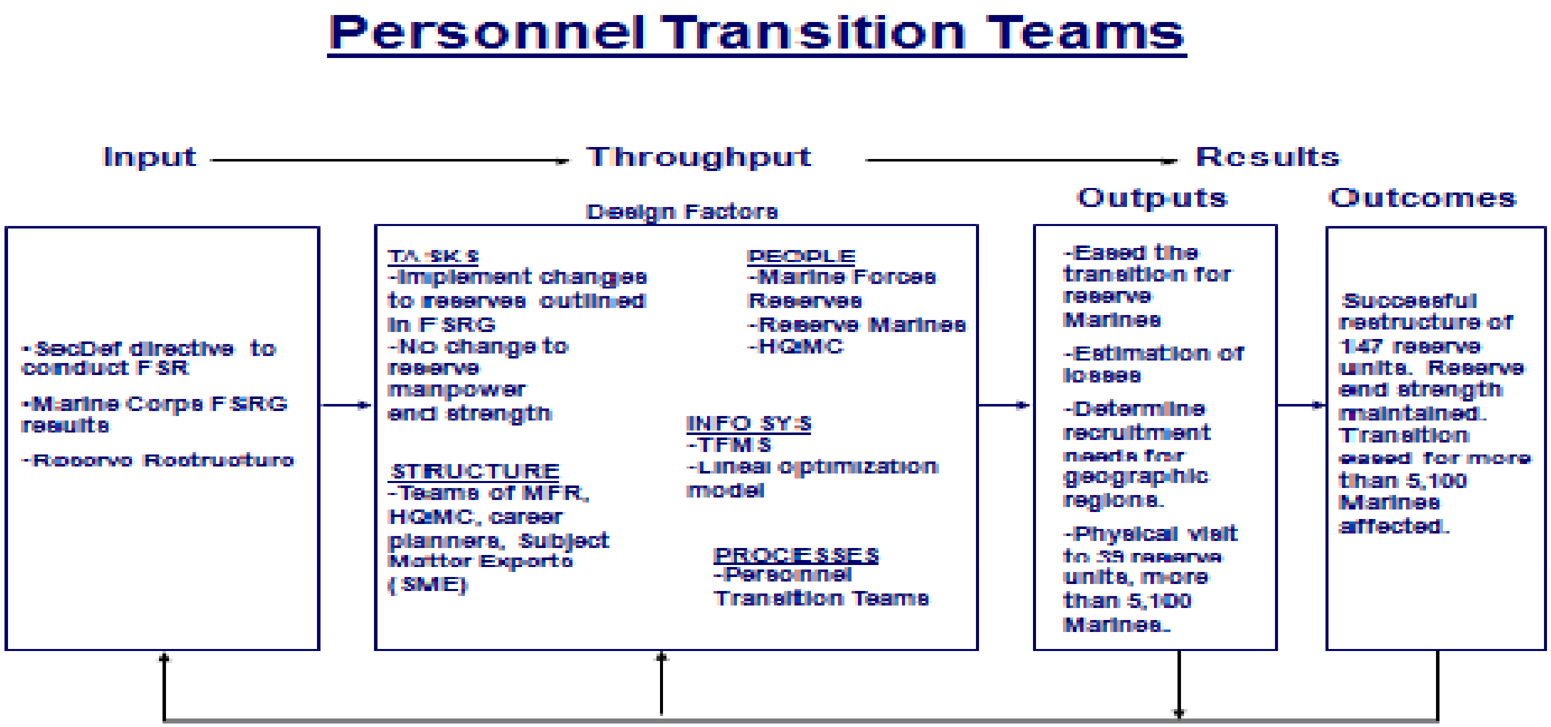

Figure 2. Personnel Transition Team system model

B. INPUT

Two important events drove the requirements for the development of the PTT concept. The first event is SecDef Gates's directive for the Marine Corps to conduct a FSR. The SecDef's directive initiated the Marine Corps FSRG—an internal analysis of the Marine Corps structure, manpower, and focus. The Marine Corps FSRG identified major changes to the active, reserve, and civilian components. Changes to the MCR were substantial, directing a restructure of the reserves to meet numerous objectives. The Marine Corps FSRG provided the MFR with a task; the MFR was responsible for developing a process to execute the task. The unique nature of restructuring the MCRs required the MFR to develop a unique approach.

C. DESIGN FACTORS

The inputs feed information and requirements into the design factors. The design factors are all elements that contributed to the development of the PTTs. They consist of the task, people required to complete the task, systems used, structure developed, and process to complete the task.

Based on the changes outlined in the Marine Corps FSRG, the MFR was tasked with executing the changes to the reserve structure, while maintaining current manpower end strength numbers. The MFR developed a process to identify which units and personnel would be affected, how they would be affected, and how to implement the necessary changes.

The MFR developed two phases to aid the planning process. The planning phase was used to assess the potential risk loss of personnel from the restructuring of reserve units. A lineal optimization model was developed to compare a current geographic location on-hand inventory to a proposed Table of Organization (T/O) (Poole, 2014). The Billet Identification Code (BIC) assignment policy (ensuring assignment of personnel to billets commensurate with their grade, MOS, billet or training) was also used to assess the potential loss of personnel from the restructuring of units. The lineal optimization

model was instrumental in the MFR capability to predict expected loss and recruitment needs during this process.

The execution phase is the second part of the MFR planning process and establishes the PTTs. According to the *Marine Forces Reserve Command Chronology*, the PTT approach was designed to be “a proactive solution to the challenge of conscientiously balancing the need to protect the overall end strength number, purposefully and expeditiously dismantle and rebuild unit-specific capabilities, and keep faith with Marines and communities” (Poole, 2014).

Teams consist of members from MFR G-1 Manpower and Reserve Affairs, career planners, and subject matter experts in the requirements for a coming SMCR unit (Cook, 2012). On occasion Marine Corps Recruiting Command would attend to offer AR opportunities to those eligible Marines. The right match of team members was a critical element to the PTT concept. Their responsibilities ranged from briefing Marines individually on options available to expediting processes that normally take months into just a day. The PTTs only visited units that were determined to have a potential high SMCR manpower loss. A high SMCR manpower loss was considered as an end strength decrease or effective personnel loss exceeding 50 SMCR Marines (Poole, 2014).

In July 2012, the Commander of Marine Forces Reserve directed a PTT to selected units across the country (Poole, 2014). In 16 months, PTTs conducted 39 on-site visits, counseling over 5,100 Marines (Wonderlich, 2014). Figure 3 shows the physical sites visited by the PTTs. When a PTT arrived on-site, it briefed the Marines on the changes occurring at their unit. Each visit differed depending on the severity of the change to the unit, as described in Chapter I. Options briefed to Marines were restricted in some cases due to contractual obligations with the Marine Corps and their location in respect to another reserve site.

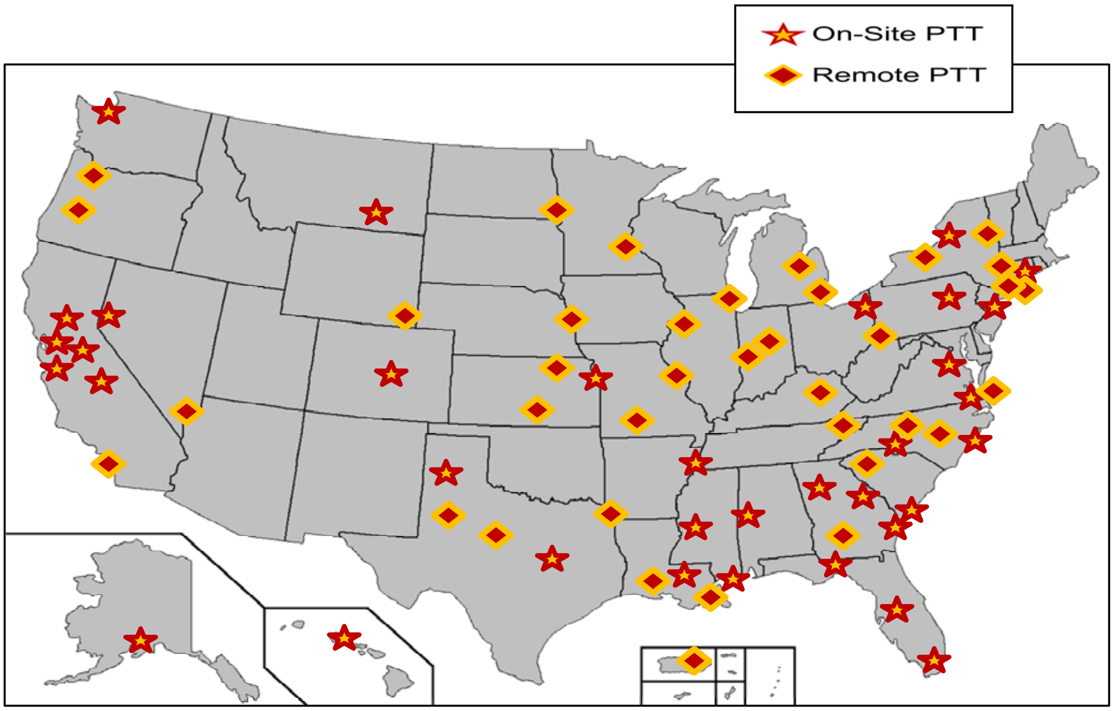

Figure 3. PTT on-site and remote visit map (from MFR, 2013b)

The PTTs classified Marines into one of two categories based on their Mandatory Drill Participation Stop Date (MDPSD). MCO1001R.1K defines a MDPSD as the "date in which a non-prior service (NPS) reserve component officer/enlisted Marine has met their mandatory drilling obligation with an SMCR unit. Contractually binding, this minimum period of obligation to affiliate is determined based upon the member's initial accession program agreements" (CMC, 2009). A Marine that has not met his or her mandatory drilling obligation is considered an "obligor," while a Marine that has met the mandatory drilling obligation is considered a "non-obligor." Each classification carries its own set of limitations and available options. PTTs briefed the 11 options available depending on a Marine's obligor or non-obligor status and his or her location to another reserve unit. The 11 options available to Marines are shown in, Table 1.

Inter-Unit Transfer (IUT): Occurs when Marines transfer from their current unit to another SMCR unit.
1. IUT Excess: Marines can join unit with no open BIC.
2. IUT Lateral Move: A Marine transfers from one MOS to another. There are standards and a qualification that must be met depending on the MOS the Marine is attempting to move into.
3. IUT Match: Marine transfers to another unit and matches a BIC at that unit.
4. IUT Mismatch: Marine transfers to another unit and does not match a BIC at that unit. If this occurs the Marine will serve in that capacity until reaching the MDPSD.
Stay: Occurs when Marines choose to stay with their current unit. This can only occur if the unit will remain activated. Marines will not have the option to stay with units that were completely divested.
5. Stay Excess: Marine chooses to stay with current unit and does not fill a BIC.
6. Stay Lateral Move: A Marine chooses to stay at the current unit and laterally move to the new MOS designated for that unit.
7. Stay Match: If the Marine matches a BIC at that unit and there is space available, he or she may choose to stay and fill that BIC.
Transfer: A change in a Marine's duty status. Marines had the options of transferring.
8. Transfer to IRR.
9. Transfer to IMA.
10. Transfer to AR.
11. Inter-Service Transfer (IST): The transfer from Marine Corps active or reserve component to another service's active or reserve component.

Table 1. Decisions available to Marines (from CMC, 2009)

1. Obligors

PTTs further separated obligors into two additional groups, obligors within 100 miles of a reserve unit and obligors not within 100 miles of a reserve unit. Although obligors are contractually obligated, those with units beyond 100 miles exceed the maximum distance a mandatory participant may be required to travel. According to MCO 1001R.1K, 100 miles, or a distance traveled by automobile under normal conditions in three hours, is the standard of travel an obligor can be required to travel involuntarily between his or her residence and the Reserve Training Center. Marines beyond these

limitations may request waivers in order to continue to affiliate with the reserve unit. Obligors are more restricted in their options than non-obligors due to their contractual obligations with the Marine Corps. The 11 options available to obligors within and not within 100 miles of a reserve unit are illustrated in Table 2.

Decision	Obligor within 100 miles	Obligor not within 100 miles
IUT Excess	X	
IUT Lateral Move	X (if no open BIC or T/O match elsewhere)	X
IUT Match	X	X
IUT Mismatch	X (until MDPSD)	X
Stay Excess	X	
Stay Lateral Move	X (if no open BIC or T/O match elsewhere)	X
Stay Match	X	X
Transfer AR	X	X
Transfer IMA	X	X
Transfer IRR		X
IST	X (active component only)	X

Table 2. Options available to obligors within and not within 100 miles of a unit

a. Obligors Within 100 Miles of a Reserve Site

The PTT presented various options to Marines during on-site visits outlining more details regarding obligors within 100 miles of a reserve unit (MFR, 2013c).

- Obligors within 100 miles of a reserve site are required to drill until MDPSD, even if there is no MOS requirement at the new unit.
- They can be joined "excess" to any SMCR unit. The first option is to fill a match.
- They are normally not retrained in a new MOS if they qualify to fill an open BIC or T/O match. They can request to retrain on a case-by-case basis.

- An IST will be approved to any active component. ISTs for obligors will be denied to another reserve component.

b. Obligors Not Within 100 Miles of a Reserve Site

The PTT presented various options to Marines during on-site visits outlined more details regarding obligors not within 100 miles of a reserve unit (MFR, 2013c).

- Obligors not within 100 miles or a reserve site may request transfer to IRR.
- They can be joined "excess" to any SMCR unit. The first option is to fill a match.
- They can request to retrain in new MOS.
- An IST will be approved to any active and reserve component.

2. Non-Obligors

Non-obligors are less restricted in their options because they have fulfilled their contractual obligations with the Marine Corps, as illustrated in Table 3.

Decision	Non-Obligor
IUT Excess	
IUT Lateral move	X (only to open BIC)
IUT Match	X
IUT Mismatch	
Stay Excess	
Stay Lateral Move	X
Stay Match	X
Stay Mismatch	X (only for nine months)
Transfer AR	X
Transfer IMA	X
Transfer IRR	X
IST	X

Table 3. Options available to non-obligors

The PTT presented various options to Marines during on-site visits offering more details regarding non-obligors and their options (MFR, 2013c).

- Non-obligors cannot join "excess" to any unit; they must fill an open BIC.
- They can request to retrain in a new MOS to an open BIC in any SMCR unit.
- An IST will be approved to any active and reserve component.

According to the PTT smart sheet, over the course of 13 months, the PTTs visited 39 units and counseled over 5,200 Marines. Of the Marines counseled, more than 1,900 SMCR Marines matched the T/O of the new unit or a nearby unit. Another 824 Marines chose to retrain to a new MOS. The remaining Marines chose to remain at their current SMCR units as a match or excess until their MDPSDs, transferred to the IRR, or executed an IST (Hummer, 2013).

D. OUTPUTS

Through this process, MFR manpower developed tools to help estimate losses and better predict recruitment needs. Also, detailed data collection helped to identify issues that later contributed to a savings of over $4 million.

A lineal optimization model was developed and implemented during the planning phase. The model utilized on-hand inventories, proposed T/Os and BIC assignment policies to assess potential risk loss at the unit level. The model allowed early detection of recruitment needs and potential losses in units (Poole, 2014). The usefulness of this model extends beyond this one-time use; the model can be expanded to help estimate loss for future incidents.

Another useful output developed during this process was the collection of data on all FSRG activities and its use to fix full-time support (FTS) issues. FTS personnel are responsible for "assisting in the organization, administration, recruitment, instruction, training, maintenance and supple support to the Reserve component" (Deputy Secretary of Defense, 2000). The database allowed MFR manpower to identify and correct 490 FTS potential misalignments. The prevention of these misalignments resulted in savings of $4.9 million.

E. OUTCOMES

The outcome of the PTT process was a successful restructure of reserve units. The MFR was able to complete the task assigned through the FSRG while maintaining the current manpower end strength. The process required countless hours of work and some ingenuity to adapt to substantial changes in the reserve force structure. Lessons learned from this process will benefit the Marine Corps in the future. The processes developed and planning executed can be referenced to help guide future changes and how to deal with them.

F. SUMMARY

The PTTs were a critical element to the MCR restructuring. The development of the PTT concept was a complex process that required countless hours of work and coordination with different elements. The MFR’s forward thinking and dedication to the Marines under its command contributed greatly to the success of the PTT concept. The data collected during the process allows for further analysis that will better prepare the Marine Corps in similar incidents.

Chapter II provided an explanation of the background, RR structure, and PTT concept. Chapter III discusses research related to this thesis. The similarities of research discussed in Chapter III are the utilization of the logistic regression model, the focus on the MCR, and the use of similar variables in the models.

III. LITERATURE REVIEW

A. INTRODUCTION

Due to the immaturity of this topic, little information focuses specifically on the changes to the reserves brought on by the FSR. However, there are studies that examine similar topics regarding the reserves and variables that contributed to a Marine's career decisions. Three previous Naval Postgraduate School theses utilize logistic regression models to predict significant factors that affect retention in the SMCR.

Differences between these studies include the selection of variables for the logistic regression model, the amount and types of data used for the analyses, and the main focuses of the theses. Some similarities exists between the studies examined in this chapter and this thesis, specifically the use of the logistical regression model, focus on the reserves and retention, and similarities between some variables used.

B. FACTORS INFLUENCING THE RETENTION OF NONCOMMISSIONED AND STAFF NONCOMMISSIONED OFFICERS IN THE SELECTED MARINE CORPS RESERVE

Jeffrey Randall (1989) examines the retention of noncommissioned officers (NCO) and staff NCOs (SNCO) in the SMCR. He uses a combination of data from the 1986 Reserve Components Survey and 1989 statuses from the Reserve Components Common Personnel Data System. Randall separates the data into four groups: prior service (PS) single, PS married, NPS single, and NPS married. A logistic regression model examines the effects of economic, demographic, military (rank, MOS, years of service), and job satisfaction variables on retention in the SMCR. Randall's thesis finds that different variables for all four groups had a significant impact on retention decisions.

The research conducted in this thesis draws man similarities with the research in Randall's thesis. The data is compiled into four groups based on the Marine's service and marital status. There are, however, some differences. Randall focuses on one dependent variable, "retention." He defines retention as "a member's decision to remain in the SMCR (either re-enlisting or extending) at the end of his current commitment" (Randall,

1989). His thesis concludes that monetary variables influence both NPS married and single retention. Satisfaction variables also influence NPS single Marines'. Job, family, and tenure influence PS married Marines' decisions to retain, while tenure and retirement influenced PS single Marines' decisions to retain.

C. FIRST-TERM RETENTION OF ENLISTED SELECTED MARINE CORPS (SMCR) RESERVISTS

O'Donohue (1988) examines male, first-term enlisted reservists and the factors that influence their decisions to remain in the SMCR after their first terms. O'Donohue splits his data set into two groups, consisting of NPS and prior active service reservists. O'Donohue uses the same data set sources that Randall uses. His thesis concludes that income, educational benefits, retirement, and civilian job-related training significantly affects a Marine's decision to stay.

O'Donohue's variables consist of demographics, income, reserve occupations, civilian occupational variables, and regional and perceptual variables. The combined sample size is 1046; 752 were NPS and 294 were PS reservists. The research conducted in this thesis is similar to O'Donohue's research, due to the focus of the reserves, variable selection, data splitting, and use of the logistic regression model.

D. CONTINUATION RATES FOR STAFF NONCOMMISSIONED OFFICERS, IN A NON-OBLIGOR STATUS, SERVING IN THE SELECTED MARINE CORPS RESERVE

Reginald Hairston examines the factors that influence the retention of male SNCOs who are in a non-obligor status in the SMCR (2004). The data source is the Reserve Component Common Personnel Data System. Hairston uses demographic and military variables to determine the effects on retention for Marines with 15 and 18 years of service. Variables used in this thesis are similar to those used in Hairston's thesis. The focus on non-obligors is a good choice because they have no contractual obligations, and thus have more freedom with their career decisions. Obligors are under contractual obligations, so their choices are more restricted than those of non-obligors.

Hairston uses independent variables such as marital status, family status, dependents, race, education, rank, and MOS. The model consists of dichotomous dependent variables; Marines who stay to 15 years or not, and those who stay to 18 years or not. Hairston's models determine that single Marines' with no dependents are more likely to separate than those who are married with dependents. Also, high rank significantly affects Marines' chances of reaching the 15- and 18-year marks.

E. SUMMARY

Similar variables used in each study focus on demographics, career, performance, and economic conditions. Each thesis finds similar variables that affect a Marine's decision to retain. The theses reviewed in this chapter focus mainly on retention in the MCR. They each provide good information and tools for the MCR. The research conducted in this thesis focuses on retention to an extent, but also looks at other decisions an SMCR Marine could make during the restructuring process.

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IV. DATA AND VARIABLE DESCRIPTION

A. INTRODUCTION

This chapter summarizes the data used in this thesis and explains the data source, the content, and the adjustments made to the data for this study. This chapter also identifies and describes the dependent and independent variables used in the study.

Selecting the correct independent variables to explain the dependent variables is critical element of a good logistic regression model. Hosmer, Lemeshow, and Sturdivant, describe the goal of logistic regression models as “the same as that of any other regression model used in statistics, that is, to find the best fitting and most parsimonious, clinically interpretable model to describe the relationship between an outcome (dependent) variable and a set of independent (explanatory) variables” (Hosmer, Lemeshow, & Sturdivant, 2013, p. 1).

B. DATA

The MFR provided the data for this thesis is an Excel file consisting of information on 5,190 SMCR Marines who were affected by the FSR and visited by the PTTs during the reorganization of the reserve units. The dependent variable of focus in this thesis is a Marine’s decision made during the reserve reorganization. A variable in the data records each Marine’s decisions, which we use to create the dependent variables for the logistic regression models. The data also provide 77 possible explanatory variables. Not all variables contain enough information for use in the model and some are not sufficiently relevant. We use explanatory variables that consist of a Marine’s demographics, education, performance, MOS, deployment history, current duty status, and location.

Of the 14 possible options a Marine could choose, three are deleted from the data set because the decision made is not clear. Marines with the decisions; remote, not present, or involuntary separation are deleted from the data set, bringing the total observation size from 5,190 to 4,170.

The decisions available to Marines depend on certain specifications, such as whether the Marines are obligors or non-obligors or whether there is a reserve site within 100 miles. To account for these circumstances, the data in this thesis is split into three separate datasets:

- *Obligors with a site within 100 miles* (Dataset A).
- *Obligors with no site within 100 miles* (Dataset B).
- *Non-obligors with sites within and not within 100 miles* (Dataset C).

C. VARIABLES

The data from MFR consists of a possible 77 explanatory variables and 11 dependent variables.

1. Dependent Variables

Eleven decisions were available to Marines, and are displayed in Table 4.

Variable	Observations	Level
IUT Match	456	=1 if chosen, 0 if not
IUT Mismatch	101	=1 if chosen, 0 if not
IUT Excess	214	=1 if chosen, 0 if not
IUT Lateral Move	281	=1 if chosen, 0 if not
Stay Excess	806	=1 if chosen, 0 if not
Stay Lateral Move	533	=1 if chosen, 0 if not
Stay Match	1,495	=1 if chosen, 0 if not
Transfer AR	6	=1 if chosen, 0 if not
Transfer IMA	6	=1 if chosen, 0 if not
Transfer IRR	215	=1 if chosen, 0 if not
IST	57	=1 if chosen, 0 if not

Table 4. All dependent variables in the MFR dataset with observations

When we separate the data into the three datasets, some datasets contain too few observations of certain dependent variables. In order to mitigate this problem, we aggregate the dependent variables to just include *Transfer*, *IUT*, and *Stay*. They are listed in Table 5.

Variable	Level
Transfer	= 1 if a Marine chose AR, IMA, IST, or IRR; 0 if not
IUT	= 1 if a Marine chose IUT match, mismatch, excess, or lateral move, 0 if not
Stay	= 1 if a Marine chose to stay excess, lateral move, or match, 0 if not

Table 5. Aggregated decisions to make three primary dependent variables

Tables 6, 7, and 8, provide an overview of the decision variables observation sizes and total observations for each model.

Variable	Observations
Transfer	103
IUT	816
Stay	1,953
Total	2,872

Table 6. Obligor with a reserve site in 100 miles (Dataset A)

Variable	Observations
Transfer	82
IUT	70
Stay	380
Total	532

Table 7. Obligor with no reserve site in 100 miles (Dataset B)

Variable	Observations
Transfer	99
IUT	166
Stay	501
Total	766

Table 8. Non-obligor reserve site within and not within 100 miles (Dataset C)

2. Independent Variables

We break down the 41 independent variables for the logistic regression models into the following categories:

- MOS
- Demographics
- Education
- Location
- Performance
- Career
- Deployment

a. Military Occupational Specialty

The dataset consist of 184 MOSs that are aggregated into three categories—combat service support (CSS), aviation, and combat arms—for use in the model. Table 9 illustrates the coding of the MOS dummy variables and the frequency for each of the three datasets. The letters A, B, and C correspond to the datasets as labeled above.

Variable	Level	A	B	C
CSS	=1 if MOS is CSS, 0 if not	2,360	332	611
combat arms	=1 if MOS is combat arms, 0 if not	506	189	133
aviation	=1 if MOS is aviation, 0 if not	6	11	22

Table 9. MOS variable and frequencies

b. Demographics

The demographic variables consist of age, marital status, sex, race, and number of dependents. The variable *Age_PTTvisit* is a calculated variable that describes the Marines' age on the day they were visited by the PTTs. The other demographic variables are displayed in Table 10.

Variable	Level	A	B	C
Dependents	Total number of dependents	Range 0–7	Range 0–5	Range 0–10
Age_PTT visit	Age at time of PTT visit	Range 18–53	Range 18–40	Range 18–52
Sex	**Level**			
Male	=1 if Male, 0 if Female	2,758	512	714
Female	=1 if Female, 0 if Male	114	20	52
Marital Status	**Level**			
Single	=1 if Single, 0 if Married	478	109	391
Married	=1 if Married, 0 if Single	2,394	423	375
Race	**Level**			
White	=1 if White, 0 if not	2,206	443	557
Black	=1 if Black, 0 if not	412	37	88
Other (American Indian or Alaska native, Asian, Native Hawaiian or other Pacific Island, declined to respond)	=1 if Other, 0 if not	254	52	121

Table 10. Demographic variables and frequencies

c. Education

The MFR dataset provides the Marine's "Civilian Education Certificate Code." The education codes are used to identify a Marine's level of education and method of attainment. The Marine's education level is broken down by code according to MCO P1100.72C Military Personnel Procurement Manual, volume 2, Enlisted Procurement. The codes as listed in the dataset are provided in Table 11.

Civilian Education Certificate Code	Description
7	Correspondence school
8	Non-high-school graduate
B	Adult education
C	Occupational program certificate of attendance
D	Associate degree
E	Test-based equivalency
H	Home school diploma
J	High school certificate of attendance
K	Baccalaureate degree
L	Traditional high school, religious, or alternative continuation high school diploma
M	Credential near completion
N	Master's degree
S	Traditional high school, religious school, adult/continuation/alternative or home school senior
U	Doctorate degree
X	National Guard Youth Challenge Program with GED

Table 11. Civilian education certificate code

For the purpose of this research, the civilian education certificate codes are used to create three education variables for the models, which are shown in Table 12. The variables used to describe education levels are alternate high school diploma, greater than high school diploma, and high school graduate. An alternate high school diploma indicates a Marine who has graduated high school, but not in the traditional form. A high

school graduate is a Marine who has graduated in traditional form. Greater than high school is a Marine that has an education above the high school level.

Variable	Level	A	B	C
HS_Grad	=1 if HS Graduate (L, S), 0 if not	2,588	482	571
Alt_HS_Cred	=1 if Alternate HS Diploma (7 ,B, C, E, H, J, M, X), 0 if not	65	12	24
GreaterThan_HS	=1 if Greater than HS Diploma (8, D, K ,N ,U), 0 if not	204	35	168

Table 12. Education variable and frequencies

Another measure of aptitude is the General Classification Test (GCT). The GCT is a common test from the Armed Services Vocational Aptitude Battery (ASVAB) that is used to determine an individual's intellectual ability. The MFR dataset consists of 37 Marines with missing GCT scores. To avoid dropping these observations in the model, the average GCT for all observations is computed. The average is applied to the Marines missing GCT scores. A dichotomous variable labeled *Missing GCT score* identifies those Marines that have a missing GCT score and an average score applied. When the variable *GCT score* is used, *Missing GCT score* is also used. This method allows the model to test the effect of the scores assigned the average GCT. The GCT variables used in this thesis are displayed in Table 13.

Variable	Level	A	B	C
GCT score	Marine GCT Score	80–150	82–149	58–150
Missing GCT score	=1 if Marine was missing GCT score, 0 if not	1	1	35

Table 13. GCT variable and frequencies

d. *Location*

The dataset provides a location the PTT visited each Marine. In order to test the effects of location on a Marine's decision, the location the PTT visits each Marine is separated by Marine Corps recruiting districts. Recruiting districts allow for an organized separation of the 45 total locations. It also displays differences between recruiting districts, which may provide critical information for recruitment depending on Marines' decisions. The Marine Corps has six recruiting districts, as Figure 4 shows. The districts' variables and associated observation sizes are illustrated in Table 14.

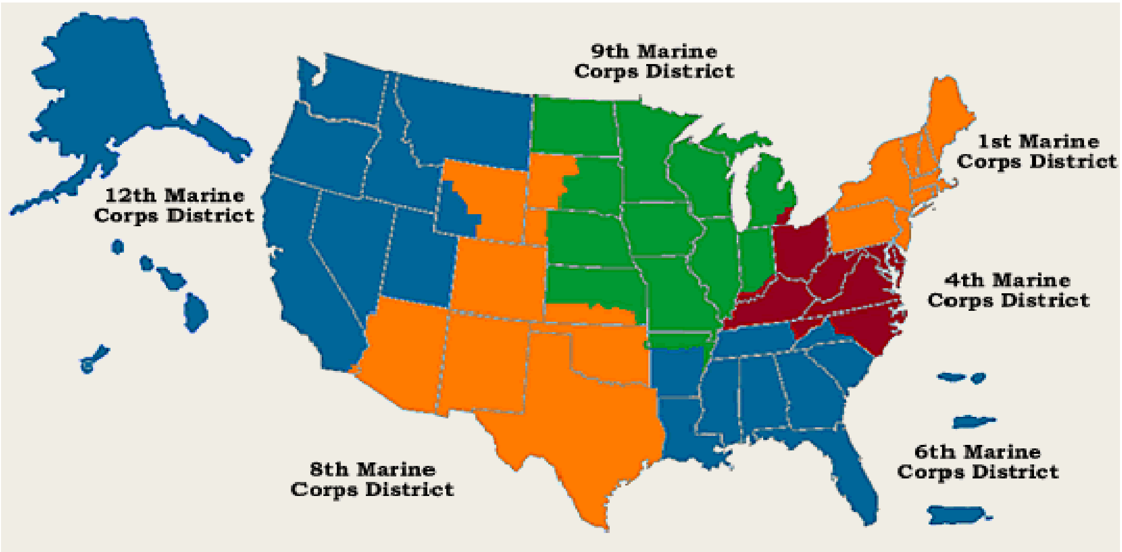

Figure 4. Marine Corps recruiting districts map
(from Marine Corps Recruit, 2010)

Variable	Level	A	B	C
District 1	=1 if District 1, 0 if not	428	18	98
District 4	=1 if District 4, 0 if not	287	1	71
District 6	=1 if District 6, 0 if not	1,244	164	337
District 8	=1 if District 8, 0 if not	112	160	64
District 9	=1 if District 9, 0 if not	287	26	80
District 12	=1 if District 12, 0 if not	514	163	116

Table 14. Districts variable and frequencies

The dataset provides three other location-related variables that we use in the model. *Number_ sites_ in 100 m* is a continuous variable that lists the total number of reserve sites within 100 miles of a Marine. This variable measures if more or fewer sites within 100 miles have an effect on a Marine's decision. *Distance_to_Current_site* is a continuous variable with total miles from a Marine's Home of Record (HOR), to his or her current reserve site. The purpose of this variable is to measures the potential affect travel distance has on a Marine's decision.

In the MFR dataset, the variable *Other unit within 100 miles* is marked "yes" if there is a unit within 100 miles and marked "no" otherwise. For use in the model, this variable is coded into two dichotomous variables, *Site_in_100miles* and *Site_NOT_in_100miles*. These are key variables in the dataset because they specify which options are available to a Marine. The location variables used in the models are displayed in Table 15.

Variable	Level	A	B	C
Number_Sites_in100mi	Total number of reserve sites within 100 miles of a Marine	1–14	0	0–14
Dis_to_Current_Site	Total distance in miles a Marine is from their current reserve site	0–2,674	0–2,626	0–2,284
Site_in_100miles	=1 if site within 100 miles, 0 if not	2,872	0	660
Site_NOTin_100miles	=1 if site not within 100 miles, 0 if it is	0	532	106

Table 15. Distance to site variable and frequencies

e. Performance

Marines are tested yearly for physical fitness and marksmanship skills. The Marine Corps has two tests for fitness, the Physical Fitness Test (PFT) and the Combat Fitness Test (CFT). Annual marksmanship skills tests are also required for the M-16A2 service rifle, M4 carbine, and the M9 pistol. These tests not only keep a Marine prepared for combat, but also become tools for evaluating a Marine's ability, performance, or motivation. The test scores have an influence on promotions, retention, and assignments.

MCO 6100.13 W/CH 1, provides details regarding the PFT and CFT, scoring, execution, and administrative procedures. As per MCO 6100.13 W/CH 1, the reserve component PFT is

> [A] scored, calendar year annual requirement for all Selected Marine Corps Reserve (SMCR) and Individual Mobilization Augmentee (IMA) Marines, regardless of age, gender, grade, or duty assignment. PFT scores will remain valid for two years for promotional purposes should operational constraints prevent annual testing. It is required to be conducted in between 1 January and 30 June of each year. (Commandant of the Marine Corps [CMC], 2008)

The PFT consists of three events: pull-up (male) or flex-arm hang (female), abdominal crunch, and three-mile run. Scores for all three events are combined for a

cumulative score. Cumulative scores account for age and gender, and are broken down into three classes: first, second, and third.

A total of 53 Marines are missing a PFT score and its associated class in the dataset. To determine the best method to include the missing observations, two models code the PFT classes differently. The first model is executed with PFT classes separated into, *PFT 1st class*, *Not PFT 1st class*, and *missing PFT*. The second model is executed with PFT classes separated into *PFT 1st class*, and *Not PFT 1st class*, with *missing PFT* classified under *Not PFT 1st class*. There are no significant differences between the models, so PFT is classified as *PFT 1st class* and *Not PFT 1st class* in the final model, as shown in Table 15.

The CFT is conducted during the second half of the calendar year. The requirements for the reserve component are the same as those outlined above for the PFT, as per MCO6100.13 W/CH 1. The CFT also consists of three events: Movement to Contact, Ammunition Lift, and the Maneuver Under Fire. Classification for the CFT is also first; second, and third class, but there are no differences or separated events based on gender or age (CMC, 2008). Each event does have maximum and minimum criteria based on gender and age.

The dataset contains 208 Marines with missing CFT scores and classifications. We apply the same procedures for the missing CFT information as applied for the missing PFT information. There are no significant differences between *including missing CFT* as a variable in the model, or combining *missing CFT* with *Not CFT 1st class,* therefore CFT is classified as *CFT 1st class* and *Not CFT 1st class* in the final model, as shown in Table 16.

A Marine is required to qualify annually with the M16-A2 service rifle, M16-A4 service rifle, or the M4 carbine. MCO 3574.2K identifies the requirements for qualification, scoring, and administrative matters pertaining to yearly rifle qualification. Like the PFT and CFT, rifle qualification scores are broken into three categories: expert, sharpshooter, and marksman. Rifle qualification ensures Marines are prepared to properly

handle and effectively engage their weapons when necessary. Scores may also be an indicator of a Marine's ability and motivation.

The dataset contains 396 Marines with missing rifle scores and classifications. The same procedures applied above for PFT and CFT are applied here. There are no significant differences between the two models that include *missing rifle score* as a variable, and combining *missing rifle score* with *Not rifle expert*. The rifle variable is coded as *Rifle expert* and *Not rifle expert*. The PFT, CFT, and rifle variables used in the models are displayed in Table 16.

Variable	Level	A	B	C
PFT 1st class	=1 if 1st class, 0 if not	1,919	332	562
Not PFT 1st class	=1 if other than 1st class, 0 if 1st class	953	200	204
CFT 1st class	=1 if 1st class, 0 if not	2,210	407	552
Not CFT 1st class	=1 if other than 1st class, 0 if not	662	125	214
Rifle expert	=1 if Rifle Expert, 0 if not	1,383	254	356
Not rifle expert	=1 if not Rifle Expert, 0 if Expert	1,489	278	410

Table 16. Performance variable and frequencies

f. Career

The two career variables used in the model are *rank* and *total satisfactory years*. These variables provide indicators to a Marine's time in service, progression, potential for responsibility, and years until retirement. Factors such as these may impact a Marine's decisions in different ways. Rank in the dataset ranges from the lowest (E-1) to the highest (O-6). The rank variables are displayed in Table 17.

Variable	Level	A	B	C
E-1 through E-3	=1 if rank E-1 through E-3, 0 if not	1,714	306	28
E-4 through E-5	=1 if rank E-4 through E-5, 0 if not	1,072	218	472
E-6 through E-9	=1 if rank E-6 through E-9, 0 if not	38	1	186
O-1through O-3, W-1through W-5	=1 if rank O-1 through O-3, or W1 to W5, 0 if not	46	7	50
O-4 through O-6	=1 if rank O4 through O6, 0 if not	2	0	30

Table 17. Rank variable and frequencies

Total satisfactory years are critical to a Marine's retirement in the reserves. "A reservist must earn a minimum of 50 points per anniversary year and serve a full 365/366 day period to complete a qualifying year for retirement purposes" (CMC, 2009). According to the MCRAMM, retirement credit points can be earned in different ways:

- A reservist can earn points by completing active duty while serving with the AC, active duty for operational support (ADOS), active duty training (ADT), annual training (AT), extended active duty, and on the AR program.
- One active duty point can be earned for each day performed with or without pay of ADOS, ADT, AT, or AR, including days of authorized travel.
- One inactive duty point is awarded for each four hours of inactive duty training performed with or without pay. A minimum of four hours of Inactive Duty Training is required to receive retirement credit.

The *total satisfactory year's* variable, and the range of years for each model are displayed in Table 18.

Variable	Level	Range
Total_sat_year	Number of years attained toward retirement (continuous variable)	0–29 years

Table 18. Total satisfactory years variable and range

g. Deployment

Deployments can affect a Marine's career in many ways. Some Marines may desire to deploy many times, while others may not. Deployments require Marines to leave families and jobs, which may have a substantial effect on their decisions to stay or leave the MCR. The deployment variable tests any effects deployment may have on a Marine's decision. The dataset provides dates for a Marine's deployment. Marines with a date are determined to have a deployment and those without a date are determined to not have a deployment. The deployment variables are displayed in Table 19.

Variable	Level	A	B	C
Deployment	=1 if Marine had deployment date, 0 if not	667	116	622
No deployment	=1 if Marine did not have deployment date, 0 if Marine did	2,205	416	144

Table 19. Deployment variable and frequencies

h. Model Baseline Characteristics

Each model uses the same set of baseline characteristics for comparison in the model. The baseline characteristics are defined as follows:

- Male
- White
- CSS MOS
- Rank E-1 through E-3
- Single
- Not Rifle Expert
- High School Graduate
- Deployment
- Not PFT First Class
- Not CFT First Class
- District 1

D. SUMMARY

This chapter provides an explanation of the data used for this thesis, the separation of the data into three models, and the variables selected for the models. Chapter V discusses the models, the methodology for processing the models, and the results of the models.

V. MODEL AND RESULTS

A. INTRODUCTION

This chapter discusses the nine models used to answer the primary and secondary research questions. This chapter also describes the process for variable selection, model analysis, and interpretation of the results.

B. METHODOLOGY

We use the JMP statistical software developed by Statistical Analysis System (SAS) Institute to process the models in this thesis. The logistic regression model is the best model to test the effects of independent variables on a dichotomous dependent variable. Hosmer et al. (2013) state, "What distinguishes a logistic regression model from the linear regression model is that the outcome variable in logistic regression is binary or dichotomous" (p. 1).

A sequential process is followed to develop each model, to ensure proper selection of variables, and to complete a detailed analysis of the results.

1. Variable Selection

The selection of independent variables is a key step in building a logistic regression model. Hosmer et al. (2013) recommend a careful univariate analysis of each independent variable (p. 90). We construct a univariate logistic regression model for each independent variable and dependent variable combination. As per Hosmer et al. (2013), we select all covariates with p-values less than 0.25 for consideration for step-wise regression.

After the univariate analysis, is the step-wise method of variable selection. The step-wise method selects variables to enter and exit the model based on p-value thresholds. This thesis uses an entry value of 0.15 and an exit value of 0.25. The "mixed" direction is used to add variables that satisfy the value to enter and to drop those that satisfy the value to exit the model.

2. Model Analysis

A detailed analysis of the model and its measurements is required to have a full understanding of what the model is presenting. Two methods of measurement are the R^2 value, and the Receiver Operating Characteristics (ROC) curve.

The R^2 is, "the ratio of the difference to the reduced negative log-likelihood values. It is sometimes referred to as U, the uncertainty coefficient. R^2 ranges from zero for no improvements to 1 for a perfect fit. A nominal model rarely has a high R^2, and it has a R^2 of 1 only when all the probabilities of the events that occur are 1" (SAS Institute, 2010, p. 172).

The ROC curve, "plots the probability of detecting true signal (sensitivity) and false signal (1-specificity) for an entire range of possible cut points" (Hosmer et al., 2013, p. 174). The area under the ROC curve ranges from 0.5 to 1.0 and measures the models' ability to identify those who experience the outcome of interest against those who do not. Models that are closer to 1 are considered more accurate.

C. MODELS

We use nine models to answer the primary and secondary thesis questions. The nine models are a product of three separate data sets, with each data set using three dependent variables. The three data sets are; *obligor site in 100 miles*, *obligor site not in 100 miles*, and *non-obligor site within and not within 100 miles*. The three dependent variables for each model are *transfer*, *stay*, and *IUT*. The same methodology is applied to all models to ensure accuracy.

1. Obligor Site Within 100 Miles Model

These models examine Marine obligors who have a reserve site located within 100 miles of their HOR. The purpose of these models is to determine which variables significantly affected a Marine's decision to *transfer, stay,* or *IUT*. The dataset contains 2,872 observations. Of the total observations, 103 Marines chose to transfer, 816 chose IUT, and 1,953 chose to stay. The results of the models are displayed in Table 20.

Variable	Transfer		IUT		Stay	
R^2	.11		.12		.15	
ROC	.752		.716		.728	
combat arms	–0.733	<.0001	–0.615	<.0001	0.756	<.0001
Age_PTT visit					–0.057	.0056
GCT score	0.022	.0088				
No deployment	0.287	.0277				
Dependents			–0.313	.0025	0.320	.0021
District 4			0.406	<.0001	–0.486	<.0001
District 6			0.767	<.0001	–0.818	<.0001
District 9	0.996	.0492	0.738	<.0001	–0.849	<.0001
District 12			0.769	<.0001	–0.817	<.0001
Dis_to_current_site			–0.0005	.0017	0.0004	.0077
CFT 1st class	0.249	.0272				
Rifle expert	0.290	.0093				

Table 20. Obligor site within 100 miles model results

The three models show trends between the dependent variables. The variables *combat arms, Dependents, Districts, and Dis_to_curren_site*, all appear in at least two of the models. The models show that a Marine with a *combat arms* MOS is less likely to *transfer* or *IUT,* but more likely to *stay*, compared to a Marine with a *CSS* MOS. It is common for Marines to take pride in having a combat arm MOS. Switching from a combat arm to a non-combat-arm MOS may be viewed negatively by some Marines. This may explain the way in which combat arms is represented in the model.

Dependents have a significant effect on a Marine's decision to *IUT* or *stay*. The effect for each model is different; Marines with more dependents are less likely to *IUT*, while those with more dependents are more likely to *stay*. Marines who choose *IUT* would possibly have to travel further for work, spend more time training, or move their families. These factors may encourage Marines to choose to stay at their current units.

Another interesting variable relationship is between *Districts* 4, 6, 9, and 12. Each district has a significant effect on a Marine's decision to *IUT* or *stay*. A Marine in these districts is more likely to *IUT* than a Marine in *District 1*, but less likely to *stay* than a Marine in *District 1*.

The *transfer* model contains variables that do not appear in other models. A higher *GCT score* is associated with higher odds of transferring. Marines with *no deployments*, *a CFT 1st class*, or a R*ifle expert* have higher odds of *transferring*, compared to those with a *deployment*, *Not CFT 1st class*, or *Not rifle expert*.

2. Obligor Site Not Within 100 Miles Model

These models use only Marines that are obligors and do not have a site located within 100 miles of their HOR. The purpose of these models is to determine which variables contributed to a Marine's decision to *transfer*, *stay*, or *IUT*. The models contain a total observation size of 532 Marines. Of the total observations, 82 Marines chose to transfer, 70 chose IUT, and 380 chose to stay. The results of the models are displayed in Table 21.

Variable	Transfer		IUT		Stay	
R^2	.33		.11		.23	
ROC	.865		.675		.797	
combat arms	–1.613	<.0001	–0.534	<.0001	1.224	<.0001
Other race			–0.888	<.0001	0.683	.0002
District 12	1.302	<.0001			–0.591	<.0001
Rifle expert	0.365	.0181				

Table 21. Obligor site not within 100 miles model results

The effect of *combat arms* is the same in these models as it is in the *obligors' site within 100 miles models*. Marines with a *combat arms* MOS are less likely than those with a *CSS MOS,* to *transfer* or *IUT*, but more likely to *stay*. The explanation for this relationship is the same as described above.

The *IUT* and *stay* dependent variable models contain the only race variable among all nine models, and they show that *Other races* are less likely to *IUT* and more likely to *stay* than *Whites*. Other race contains American Indian or Alaska native, Asian, Native Hawaiian or other Pacific Island. *Rifle expert* and *District 12* are associated with higher odds of *transferring* than *not rifle expert* and *District 1*, and Marines in *District 12* are less likely to *stay* than Marines' in *District 1*.

3. Non-obligors Site Within and Not Within 100 Miles

These models include only Marines who are non-obligors. The purpose of these models is to determine which variables contribute to a Marine's decision to *transfer*, *stay*, or *IUT*. The models contain 766 total observations. Of the total observations, 99 Marines chose to transfer, 166 chose IUT, and 501 chose to stay. The models results are displayed in Table 22.

Variable	Transfer		IUT		Stay	
R^2	.23		.09		.12	
ROC	.826		.696		.721	
combat arms aviation	–0.903	<.0001	–0.407 –1.161	.0004 <.0001	0.876 0.977	<.0001 .0001
Age_PTT visit	0.146	.0006			–0.076	.0072
District 6 District 9 Dis_to_current_site Site_in_100_miles	 1.102	 .0328	0.331 0.387 –0.341	.0012 .0260 .0419	–0.310 –0.566 0.0007	.0006 .0007 .0211
PFT 1st class CFT 1st class	0.347	.0061	 –0.268	 .0329		
E-6 through E-9 Tot_sat_years	0.615	.0234	–0.320	.0041	 0.070	 .0310

Table 22. Non-obligor site within and not within 100 miles model results

Like the previous models, a Marine with a *combat arm* MOS has the same effect in these models. Those with a *combat arm* MOS are less likely to *transfer* or *IUT*, and more likely to *stay* compared to Marines' with a *CSS* MOS.

The models show that an *aviation* MOS has a significant effect on a Marine's decision to *IUT* and *stay*. Marines with an *aviation* MOS are less likely to *IUT* and more likely to *stay*, than Marines with a *CSS* MOS.

Districts 6 and 9 significantly affect at least two of the three decisions a Marine can make. Similar to previous models, those Marines in *District* 6 and 9 are more likely to *transfer* or *IUT*, and less likely to *stay*, than Marines in *District* 1.

The models from this data set are the first to have a rank variable with significant effects. Marines of the ranks *E-6 through E-9* are associated with a higher likelihood of *transfer* than *E-1 through E-3's*, as well as a lower likelihood of *IUT*. This seems surprising at first because higher ranks typically mean more time toward retirement. The reason for the results may be that unless an *E-6 through E-9* is conducting an *IUT* to the same MOS, transferring to a new MOS at these ranks is very difficult. Marines at these ranks are expected to be very experienced and knowledgeable in their MOSs. Some billets require rank and experience that a newly trained *E-6 through E-9* may not be able to fill.

D. CROSS VALIDATION

Cross validation tests how well the model classifies information outside of the data used. According to Hosmer et al. (2013), a purpose of validation is, "may be especially important when the fitted model is to be used to predict the outcome for future subjects" (p. 202). For each model a "test" set and a "training" set is created to help determine the misclassification rate. We excluded the "test" set to represent data outside of the model. The "training" set remains in the model to represent the original data. We process the models exactly the same way as the models above. We saved probabilities for each model to provide an estimate for which observations "most likely" chose to *transfer*, *stay*, or *IUT*. A comparison is conducted between the "most likely" estimates, the "test" and "training" sets. Observations classified incorrectly represent the misclassification rate for each model. The misclassification rates from the cross validation is displayed in Table 23.

Model	Transfer		IUT		Stay	
	Training	Test	Training	Test	Training	Test
Obligor Site in 100 miles	3.4%	3.9%	23.0%	26.2%	25.7%	26.1%
Obligor Site not in 100 miles	13.6%	9.7%	11.2%	8.8%	19.1%	15.9%
Non-Obligor	12.9%	8.9%	21.7%	18.3%	28.4 %	24.0%

Table 23. Model misclassification rates

E. DECISION PROBABILITY MODEL

The ability to estimate a Marine's decision may be very beneficial to components affected by change like the FSR. The models developed for this thesis can be used to estimate decisions Marines may make when faced with similar circumstances. In Table 7,

the observations for the dependent variables in the data set *obligor's site not within 100 miles* are listed. The observations show that 15% of Marines choose to *transfer*, 13% choose an *IUT*, and 71% choose to *stay*. These are known probabilities from the data set MFR provided for this thesis. In the case of a future FSR or similar event, the ability to estimate the decisions Marines may make will help the planning and execution of changes.

Suppose, for example, that MFR determines that a future FSR affects a set of 500 (notional) Marines[1]. Suppose further that these Marines are in the *obligor not within 100 miles* category. The models from *obligor site not within 100 miles* can be used to classify these Marines into those most likely to *IUT*, *stay*, or *transfer*. We simply apply the prediction equations for those three models to each new observation. We classify each observation according to the model that yields the highest probability estimate. The results of the 500 Marines' estimated decisions are illustrated in Figure 5.

[1] We drew a random sample of 500 Marines from the *Obligor_within_100_miles* dataset in an effort to create a new representative dataset.

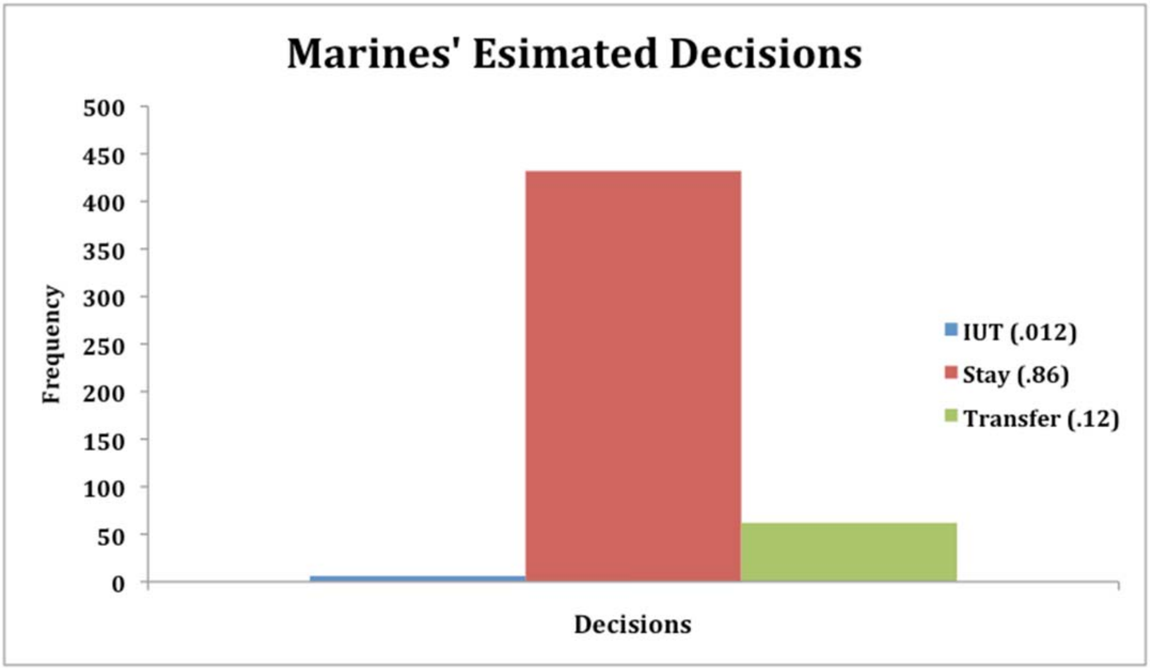

Figure 5. Decision probability model

Figure 5 shows the estimated probabilities of the 500 Marines as a 1.2% probability of choosing an *IUT*, an 86% probability of choosing to *stay*, and a 12% probability of choosing to *transfer*. The models account for many different factors that may contribute to each Marine's decision. The estimated probabilities now provide a snapshot of the potential effects of upcoming changes. The probabilities in this model can be used for planning, execution, and recruitment needs.

F. CHAPTER SUMMARY

The models in this chapter answer the primary and secondary research questions. The first research question asks which variables significantly contributed to an SMCR Marine's decision when faced with unit changes from the FSR. There are many variables that have significant effects across all models. The variable *combat arms* have the same relationship represented in every model. Thus, a Marine with a *combat arms* MOS is less likely to *transfer* or *IUT*, and more likely to *stay*, than a Marine with a *CSS* MOS. Districts also appear in multiple models, with the results that Marines in these Districts are more likely to transfer or *IUT*, and less likely to *stay,* than Marines in *District* 1. This

information provides a better understanding to what may or may not drive a Marine to make certain decisions. Further, splitting the data into groups depending on contractual status and distance to sites allowed us to develop a decision probability model.

A decision probability model answers the second research question of, what the estimated probability is that a Marine will choose to *stay*, *IUT*, or *transfer* in future FSRs or similar events. The decision probability model provides a tool that may be used to determine the potential effects of changes in the Marine Corps. A group of Marines can be added to each model to estimate what they may decide when faced with similar changes. The estimates may help determine potential loss or retention depending on a Marine's decision.

VI. SUMMARY, CONCLUSIONS, AND RECOMMENDATION

A. SUMMARY

In August 2010, SecDef Gates ordered the Marine Corps to conduct a FSR. The Marine Corps acted on the directive with the creation of the FSRG. The results of the FSRG called for major changes to the active, reserve, and civilian components of the Marine Corps. The changes to the reserve component were to create an operationalized reserve component, to reorganize the MLG, to establish and align CLBs to specific MEUs and infantry regiments, to increase civil affairs, counterintelligence and human intelligence, and to increase air and naval gunfire liaison companies.

The changes created a difficult task for the MFR. To help with the execution of the changes, the MFR created the PTT concept. The teams physically visited more than 5,100 Marines spread over 39 sites across the United States. The PTT's focus was to ease the transition of the Marines affected by the FSR. Teams personally counseled Marines about the available options and expedited processes that normally take months into days.

This thesis serves three purposes. First, it predicts significant factors that contributed to an SMCR Marine's career decision when faced with unit changes from the FSR. Second, it provides the Marine Corps with a reference to the unique concept of the PTT developed by MFR. Third, it provides a decision probability model to help estimate future Marines' decisions when faced with similar events to the FSR.

The data collected by the PTTs is used to conduct an analysis of how Marines made decisions. Variables such as MOS, demographics, education, location, performance, career, and deployment are used to determine the effects of occupation, personal life, and ability on a Marine's decision. Separating the models based on contractual obligation and location to another site provided the opportunity to test each group of Marines separately.

The secondary purpose of this thesis is to provide the Marine Corps with a reference to the PTT process developed by the MFR. The MFR developed this concept in response to the changes outlined in the Marine Corps FSR. The PTT concept was a

critical element to the MFR plan for implementing the changes at 147 reserve sites. The concept provided Marines with face-to-face counseling, which ensured Marines understood the changes to their units, and their available options. The changes to the MCR not only led to the development of the PTT's, it also forced the creation of a lineal optimization model that was critical in the MFR's ability to detect recruitment needs and potential losses in the reserves.

The tertiary outcome of this thesis is the development of the decision probability model. The decision probability model uses the three models developed in this thesis to predict the decision of Marines that may be affected by events similar to the FSR. Marines are included in the appropriate models depending on their contractual obligations and locations to another site. The model will predict what decisions the Marines may make, providing a total number for each decision and the probability of the Marines' making that decision.

B. CONCLUSION AND RECOMMENDATIONS

1. What variables significantly contributed to an SMCR Marine's decision when faced with unit changes from the FSR?

a. Conclusion

This thesis uses nine models to answer the primary research question. The three data sets used are *obligor site within 100 miles*, *obligor site not within 100 miles*, and *non-obligor site within and not within 100 miles*. Each data set contains three models using the dependent variables *transfer, stay,* and *IUT.*

(1) Obligor site within 100 miles.

The three models executed using this data set found 12 variables that significantly contributed to an SMCR Marine's decision.

The first model uses the dependent variable *transfer*. The results of this model show that the variables: *combat arms, GCT score, No deployment, District 9, CFT 1st class,* and *Rifle expert* significantly affect a Marines decision to *transfer*.

The second model uses the dependent variable *IUT*. The results of this model reveal that the variables; *combat arms*, *Districts 4,6,9,12*, *Dependents,* and *Dis_to_current_site* have a significant effect on a Marine's decision to *IUT*.

The third model uses the dependent variable *stay*. This model shows that *combat arms*, *Age_PTTvisit*, *Dependents*, *Districts* 4,6,9,12, and *Dis_to_current_site* significantly affect a Marine's decision to *stay*.

(2) Obligor site not within 100 miles.

The results of the three models processed under this data set show that the variables; *combat arms*, *Other race*, *District 12*, and *Rifle expert* significantly affect a Marine's decision to *transfer*, *stay*, or *IUT*.

The first model uses the dependent variable *transfer*. This model reveals that the variables; *combat arms*, *District 12*, and *Rifle expert* significantly affect a Marine's decision to *transfer*.

The second model uses the dependent variable *IUT*. This model shows that the variables; *combat arms*, and *Other race* (American Indian or Alaska native, Asian, Native Hawaiian or other Pacific Island, or declined to respond) significantly affects a Marines decision to *IUT.*

The third model uses the dependent variable *stay*. The results show that *combat arms*, *Other race*, and *District 12* have a significant effect on a Marines decision to *stay*.

(3) Non-Obligor site within and not within 100 miles.

The results of the three models processed under this data set show that the variables; combat arms, aviation, Age_PTTvisit, Districts 6 and 9, Dis_to_current_site, Site_in_100miles, PFT 1st class, CFT 1st class, E-6 through E-9, and Tot_sat_years significantly affect a Marines decision to transfer, stay, or IUT.

The first model uses the dependent variable *transfer*. The results show that; *combat arms*, *Age_PTTvisit*, *District 9*, *PFT 1st class*, and *E-6 through E-9* significantly affect a Marines decision to *transfer*.

The second model uses the dependent variable *IUT*. This model shows that *combat arms*, *aviation*, *Districts 6 and 9*, *Site_in_100miles*, *CFT 1^{st} class*, and *E-6 through E-9* significantly affect a Marines decision to IUT.

The third model uses the dependent variable *stay*. This model finds that the variables *combat arms*, *aviation*, *Age_PTTvisit*, *Districts 6 and 9*, *Dis_to_current_site*, and *Tot_sat_years* significantly affect a Marines decision to *stay*.

b. Recommendation

MFR can use these models to analyze the potential effects future FSR or similar events will have on the MCR. These models highlight certain variables that may affect a Marine's decision. A better understanding of what is driving a decision will help MFR estimate the effects of similar future events. MFR should continue to conduct detailed analysis of this data which may bring to light more information that contributes to a Marine's decision.

2. What is the estimated probability that Marines will choose to stay, IUT, or transfer in future FSRs or similar events?

a. Conclusion

The estimated decision probability can be calculated for future Marines that may be affected by a FSR or similar event. This tool will benefit the estimation, planning, and execution of future FSR or similar events. The model determines the estimated probabilities of the 500 Marines as a 1.2% probability of choosing an IUT, an 86% probability of choosing to stay, and a 12% probability of choosing to transfer.

b. Recommendation

MFR should use these models as a planning tool to estimate Marines decisions for future events similar to the FSR. Incorporate these models into the development phase of future FSR or similar events. Continued collection and updating of data may strengthen the models, providing stronger estimations.

C. FUTURE RESEARCH

A detailed qualitative case study would benefit the MFR and better determine the effect PTTs had on Marines. This thesis recommends the MFR conduct surveys and interviews of Marines that were affected by the FSR. This information will help determine how effective Marines thought the PTTs were, and the effect the PTTs had on Marines' decisions. This information can also be used to help the MFR analyze the data regarding this issue.

A further recommendation is the conducting of a cost benefit analysis on the cost of retaining Marines. Costs to consider are transfer cost from one unit to another, retraining cost into a new MOS, and the cost of a new reserve recruit. Identifying costs and benefits will help shape what decisions a Marine should be offered.

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